



**Description of
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Application of the invention

The invention relates to a parallel kinetics machine with a base plate and several with this connected support arms, which are at least in their upper part to meant Mittelsenkrechten inward an inclined arranged and which are at their upper ends by a connecting part connected with one another, so that a support structure formed composed from support arms and are connecting part is, in which over first joints upper ends of telescopic struts received, their bottom ends over second joints with a tool holder connected with one another is.

Background of the invention

Such machines belong to a new generation of machine tools with several ever telescopic struts formed from into one another arranged pipes, which are on the one hand articulated fixed at a support structure and on the other hand at a tool holder. Such would genericin accordance with-eat parallel kinetics machine the Siemens AG is in the Internet bottom <http://www.ad.siemens.de/sinumerik/html/00/parakine/parakons.htm> callably. It consists of a base plate and three with this connected support arms, which are in circumferential direction uniform from each other spaced and a bottom acute angle inclined inward run. At their upper end the support arms are by an horizontal longitudinal connecting part connected with one another, so that a support structure composed from support arms and connecting part is formed. In the connecting part telescopic struts at their upper ends are held over space-fixed arranged joints, whose bottom ends are likewise connected over joints with a tool holder. The telescopic struts are thereby at their upper and at their bottom ends over joints connected so with one another that they resemble a camera stand placed on the head. In this way a structure very resistant to bending is realized due to the triangle construction (Triangular concept), which is characterised by a good stability and an high accuracy in the positioning of the tool. The highest stability of such a parallel kinetics machine and thus the highest accuracy in the position of the tool will be present whenever the telescopic struts are so aligned that they work against the common working on strength optimum. Such an optimum alignment of the telescopic struts is for example given if the struts are relative steep provided, so that a good stiffness in perpendicular direction is to be expected. However if the tool in horizontal direction becomes guided in this case, then the stiffness of the construction is reduced.

Summary of the invention

Object of the invention is it therefore, one would genericin accordance with-eat parallel kinetics machine bottom avoidance of the prior drawbacks to develop further in such a way that also with different operative positions of the tool an high stability and thus an high positioning accuracy become achieved.

This object becomes according to invention after the characterizing portion of claim 1 by the fact dissolved that the first joints at the support arms are toward the base plate and/or toward the connecting part independently displaceable arranged.

the cooperation become aligned so in dependence of the respective position of the tool to each other with one another that they work against the applied working on strength optimum. The resultant one out several force components of an existing central force system is in relation to the applied working on strength of the tool so aligned that the algebraic sum of all components and moments tends against zero. If the telescopic struts are relative steep provided, then an high rigidity in perpendicular direction becomes achieved. Become now the joints downward, D. h. toward base plate displaced, then is improved the stiffness in horizontal direction, while she decreases in perpendicular direction. There the single joints however independently toward the base plate and/or. toward the connecting part placed to become to be able, the respective operative position of the tool a corresponding optimum alignment of the telescopic struts can become realized to each other, so that a maximum at stability and thus a maximum at positioning accuracy of the tool are always possible. To second an other decisive advantage lies in the fact that the work space of the tool, which is between base plate and connecting part and is by the support arms limited becomes essential enlarged.

Advantageous embodiments of the invention are in the Unteransprüchen described. Like that are according to claim 2 provided that the support arms are in their upper part rectilinear or arcuate inward inclined arranged. Both execution variants stand equally next to each other.

After an other feature of the invention according to claim 3 is provided that the upper end of the telescopic strut of an hole of a central portion is received, this central portion with two opposite pins a wall of an hollow body the pivotal received is, the hollow body two pins longitudinal offset around 90 DEG to the first pins exhibits, which are pivotal each received of one side guide, whereby these side guides on two from each other spaced legs of the support arms are toward the base plate and/or toward the connecting part independently displaceable arranged. This universal joint-like storage of the telescopic struts is in the present case formed as sliding storage, whereby also a roll-stored displacement of the telescopic struts falls into the scope of the invention.

In other embodiment of the invention according to claim 4 the second joint should be as a ball joint formed, whereby the joint ball with the bottom end of the telescopic strut and the associated Kugelkalotte with the tool holder are connected. Just as the first joints at the upper ends of the telescopic strut also the second joints ensure for the fact that the tool holder is more movable in the work space into each direction.

After another additional feature it comes out from claim 5 that in the connecting part is received over a third joint a central tube provided with a flat, which is connected with the tool holder. In this way is ensured that a rotation of the tool holder is in circumferential direction, which affects inaccurate the positioning accuracy of the tool prevented.

Finally is in claim 6 the universal joint-like formation of this drift joint described, whereby in a first continuous recess of the connecting part with a continuous second recess of provided hollow bodies over two pins pivotal received is, is in the recess of the hollow body a central portion with two second pins pivotal received, longitudinal provided with a third continuous recess, offset around 90 DEG to the first pin and the central tube is finally displaceable received of the third recess.

The invention becomes more near explained at appended listed embodiments

Brief description of the drawings

Show:

Fig. 1 and 4 an isometric overall view of a parallel kinetics machine according to invention,

Fig. 2 and 5 an enlarged perspective view of a first joint and

Fig. 3 an enlarged perspective view of a third joint.

Detailed description of the designs

In Fig. 1 represented and with 1 designated parallel kinetics machine consists those of a circular base plate 2, on which three uniform from each other spaced inertial arms are 3 arranged, in its upper part opposite in the center the base plate 2 thought Mittelsenkrechten inclined inward run. This upper ends of the support arms 3 are by a circular connecting part 4 connected with

part 4 is. Connecting part 4 runs parallel to the base plate 2. The support arms 3 consist in their inclined portion of two from each other spaced legs 15 and 16, so that is 17 formed between these a clearance. The telescopic strut 5, D. h. their outer tube 7 is 8 received, while the bottom end of the telescopic strut 5, at the upper end of a first joint, D. h. their innertube 6 over a second joint 9 with a tool holder 10 connected is, with which again a tool 11 stands in active compound. By from each other independent shifting of the single joints 8 to each other either inward toward the connecting part 4 or outward toward periphery of the base plate 2 and by a different position of the two pipes 6 and 7 of the telescopic struts 5 to each other, a workpiece stretched on the table 12 can be worked on with the help of the tool 11 of various sides. Like the Fig. 1 continues to show, forms the three telescopic struts 5 a resistance to bending triangle construction, which resembles a stand of a camera placed on the head.

Become now for example the three telescopic struts 5 relative steep provided, D. h. the first joints 8 are in close proximity of the connecting part 4 positioned, then an excellent stiffness in perpendicular direction becomes realized. Become however the first joints 8 radial outward, D. h. toward periphery of the base plate 2 moved, then the stiffness in horizontal direction is improved. By a different position of the single joints 8 to each other rigidity conditions of the construction optimum the corresponding predetermined working on direction of the tool 11 can be adjusted in elegant manner. In order to prevent a rotation of the tool holder 10 and concomitantly the tool 11 in circumferential direction, the tool holder is 10 rigid 13 connected with a central tube, which is 14 held at its upper end in the connecting part 4 over a third joint.

Into the Fig. 2 and 5 in enlarged representation first joint shown 8 consists of a central portion 18, which exhibits a not more near designated hole to the receptacle of the telescopic struts 5 and over two each other opposite pins 19 of a wall of a prismatic hollow body 20 pivotal received is. The hollow body 20 is likewise 18 provided with a continuous recess 21 to the receptacle of the central portion. The hollow body 20 exhibits likewise two each other opposite pins 22, which are however arranged offset around 90 DEG to the first pair of taps 19. With this pins 22 the hollow body is 20 23 received pivotal in not designated receiving bores of two opposite side guides, so that the telescopic strut is reciprocally more pivotable 5 in two directions. The side guides 23 slide on the legs 15 and 16 from each other spaced by the clearance 17 in direction of arrow upward or downward.

In Fig. 3 is the third joint 14 shown, which is in a recess 24 of the connecting part 4 housed. It consists of a rotationally symmetric hollow body 26 provided with a recess 25, which is 24 pivotal received over two not visible opposite pins in the recess. In the recess 25 of the hollow body 26 again a central portion is 27 received, which exhibits two opposite pins 28, which are not offset arranged to the first visible pair of taps around 90 DEG. With this pins 28 the central portion is 27 26 received pivotal in the hollow body. The central portion 27 exhibits likewise a not designated continuous recess, which takes up the central tube 13 with its flat 29. The central tube 13 is in the central portion 27 displaceable housed, so that it can follow the tool holder 10 at various locations in the work space.

In Fig. 4 shown and parallel kinetics machine designated with 30 differs from in Fig. 1 shown by the fact only that the support arms 3 are in their upper part arcuate inward inclined arranged.

Numeral

- 1 parallel kinetics machine
- 2 base plate
- 3 support arm
- 4 connecting part
- 5 telescopic strut
- 6 pipe
- 7 pipe
- 8 first joint
- 9 second joint
- 10 tool holder
- 11 tool
- 12 table
- 13 central tube
- 14 third joint

- 16 legs
- 17 clearance
- 18 central portion
- 19 pins
- 20 hollow bodies
- 21 recess
- 22 pins
- 23 side guide
- 24 recess
- 25 recess
- 26 hollow bodies
- 27 central portion
- 28 pins
- 29 flat
- 30 parallel kinetics machine

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1. Parallel kinetics machine (1, 30) with a base plate (2) and several with this connected support arms (3), which at least in their upper part to meant Mittelsenkrechten inward an inclined arranged are and are at their upper ends by a connecting part (4) connected with one another, so that a support structure composed from support arms (3) and connecting part (4) is formed, in which over first joints (8) upper ends of telescopic struts (5) received are, whose bottom ends are connected over second joints (9) with a tool holder (10), characterised in that the first joints (8) at the support arms (3) toward the base plate (2) and/or toward the connecting part (4) independently displaceable arranged are.
2. Parallel kinetics machine (1, 30) according to claim 1, characterised in that the support arms (3) in its upper part rectilinear or arcuate inward inclined arranged are.
3. Parallel kinetics machine (1, 30) according to claim 1, characterised in that the upper end of the telescopic strut (5) of an hole of a central portion (18) received is, this central portion (18) with two opposite pins (19) in a wall of an hollow body (20) pivotal received is, the hollow body (20) two pins (22), longitudinal offset around 90 DEG, to the first pins (19), exhibits, which are pivotal received of one side guide each (23), whereby these side guides (23) on two from each other spaced legs (15, 16) of the support arms (3) toward the base plate (2) and/or toward the connecting part (4) independently displaceable arranged are.
4. Parallel kinetics machine (1, 30) according to claim 1, characterised in that the second joint (9) as a ball joint formed is, whereby the joint ball with the bottom end of the telescopic strut (5) and the associated Kugelkalotte with the tool holder (10) are connected.
5. Parallel kinetics machine (1, 30) according to claim 1, characterised in that in the connecting part (4) over a third joint (14) a central tube (13), provided with a flat (29), displaceable received is, which is connected with the tool holder (10).
6. Parallel kinetics machine (1, 30) according to claim 5, characterised in that in a first continuous recess (24) of the connecting part (4) an hollow body (26) over two pins pivotal received, provided with a continuous second recess (25), is, in the recess (25) of the hollow body (26) a central portion (27) with two second pins (28), longitudinal provided with a third continuous recess, offset around 90 DEG, to the first pins, pivotal received is and the central tube (13) displaceable of the third recess received is.